

sub
B1

ABSTRACT OF THE DISCLOSURE

When a device using GaN semiconductors is made on a hard and chemically stable single-crystal substrate such as sapphire substrate or SiC substrate, a semiconductor device and its manufacturing method ensure high-power output or high-frequency operation of the device by thinning the substrate or making a via hole in the substrate. When a light emitting device using GaN semiconductors is made on a non-conductive single-crystal substrate such as sapphire substrate, the semiconductor device and its manufacturing method reduce the operation voltage of the light emitting device by making a via hole to the substrate. More specifically, after making a GaN FET by growing GaN semiconductor layers on the surface of a sapphire substrate, the bottom surface of the sapphire substrate is processed by lapping, using an abrasive liquid containing a diamond granular abrasive material and reducing the grain size of the abrasive material in some steps, to reduce the thickness of the sapphire substrate to 100 μm or less. Thereafter, the bottom surface of the sapphire substrate is processed by etching using an etchant of phosphoric acid or phosphoric acid/sulfuric acid mixed liquid to remove a strained layer by lapping. Then, after making a via hole by etching the bottom surface of the sapphire substrate by using a similar etchant, the GaN

semiconductor layer at the bottom of the via hole is removed by RIE to expose a Au pad electrically connected to the source of GaN FET. Thereafter, a thick Au film electrically connected to the Au pad is made through the via hole. The via hole may be made by irradiation of a pulse laser beam from a CO₂ laser and subsequent etching.